WHAT IS CLAIMED IS:

1. An exposure method for transferring a predetermined pattern, which is formed on a mask including a shielding region and a transparent region, onto a specimen to be irradiated, by irradiating said mask with a light and by irradiating said specimen with the light having passed through the transparent region of said mask, comprising: dividing the light emitted from a light source into two lights so that the two lights immediately after having passed through different portions of said mask may have their phases opposed to each other by changing the individual optical paths for said two lights to reach said mask; and composing said two lights and irradiating said specimen with the composed light.

2. An exposure system to be used in the exposure method according to Claim 1, comprising a phase shift mechanism including: optical dividing means for dividing a light emitted from a light source into two halves; optical path varying means for changing the individual optical paths for the lights divided by said optical dividing means to reach said mask, to oppose the phases of the lights, immediately after hav-

ing passed through the different portions of said mask, to each other; and optical composing means for composing the two lights having passed through said mask to irradiate said specimen with the composed light.

3. A mask to be used in the exposure method according to Claim 1, comprising a pair of circuit patterns arranged so that the light having passed through the transparent region of a first circuit pattern and the light having passed through the transparent region of a second circuit pattern may come close to each other on said specimen.

4. A mask including first and second patterns each having a shielding region and transparent regions, so that a desired pattern may be formed on a specimen to be irradiated, by irradiating said two kinds of patterns with two lights having a phase difference and at least a partial coherence and by composing the transmitted patterns of said lights,

wherein the improvement resides in that said first pattern and said second pattern are formed on either a common substrate or two separate substrates so that the light having passed through the transpar-

ent regions of said first pattern and the light having passed through the transparent regions of said second pattern may interfere with each other and be weakened.

5. An exposure system comprising: a light source for emitting a luminous flux having at least a partial coherence; luminous flux dividing means for said coherent luminous flux into two halves; an optical phase shifting member disposed in either of the optical paths for composing the luminous fluxes again from said luminous flux dividing means; an optical system for composing the luminous fluxes having passed through a first pattern and a second pattern into a single luminous flux; and an optical system for reducing and projecting said single luminous flux on a specimen to be irradiated,

wherein the improvement resides in that the phases of the light having passed through the first pattern and the light having passed through the second pattern are shifted as long as 180 degrees by said optical phase shifting member to form a composed desirable pattern on said specimen.

6. An exposure method wherein the first and second patterns on said mask according to Claim 4 are ir-

radiated with two lights having a phase difference and at least a partial coherence so that the desired pattern is formed on said specimen by composing the transmitted patterns of said lights.

7. An exposure method for transferring a substantially periodic opening pattern on a mask onto a photosensitive film on a plate-shaped element to be exposed, by a size-reducing projection method over a number of periods on at least one axial direction, comprising:

(a) positioning the mask having said substantially periodic opening pattern and said plate-shaped element relative to each other;

(b) irradiating said positioned mask with an ultraviolet or far ultraviolet monochromatic luminous flux generally at a right angle in a manner to cover a predetermined pattern on said mask; and

(c) focusing the size-reduced image of said opening pattern on the photosensitive film on said plate-shaped element by condensing the monochromatic luminous flux having passed through said opening pattern by means of lens means,

wherein the opening patterns in odd and even arrays are set to have a difference of the optical leng-

th of said mask so that the lights having passed through said opening patterns in the odd and even arrays may have a phase difference of $(2n + 1)\pi$ [in which n: an integer].

8. An exposure method according to Claim 7, wherein the difference of the optical length of said mask between said opening patterns in the odd and even arrays is set by forming an additional transparent film in the opening of either of said opening patterns in the odd and even arrays.

9. A size-reducing projection exposure system comprising:

(a) an ultraviolet or far ultraviolet monochromatic light source for exposure;

(b) luminous flux dividing means for dividing the exposure luminous flux emitted from said exposure light source into main and auxiliary luminous fluxes;

(c) main mask holding means for holding a main mask substrate for transmitting a portion of said main luminous flux from the portion corresponding to said opening pattern by irradiating a first principal plane generally at a right angle with said main luminous flux;

(d) auxiliary mask holding means for holding an auxiliary mask substrate for transmitting a portion of said auxiliary luminous flux from the portion corresponding to said opening pattern, by irradiating said first principal plane generally at a right angle with said auxiliary luminous flux;

(e) luminous flux composing means for composing said main luminous flux and said auxiliary luminous flux having passed to emit at least one composed luminous flux;

(f) a projection optical system including a plurality of lenses for focusing said composed luminous flux on the principal plane of a wafer to be exposed, by a reducing projection;

(g) wafer holding means for holding said wafer so that the image plane by said projection optical system may aligned with the resist film on said principal plane of said exposed wafer; and

(h) first phase control means for controlling the relative phase difference between said main luminous flux and said auxiliary luminous flux in the optical paths of said main luminous flux and said auxiliary luminous flux.

10. A size-reducing projection exposure system ac-

cording to Claim 9, further comprising:

(i) second phase control means for controlling the phase in the optical path opposite to the side of the optical paths of said main luminous flux and said auxiliary luminous flux, at which the phase control is accomplished by said first phase control means.

11. A size-reducing projection exposure system according to Claim 10, wherein the optical path between said main luminous flux and said auxiliary luminous flux is set substantially equal for the exposure except the time necessary for the phase shift by adjusting said first and second phase control means.

12. A size-reducing projection exposure system comprising:

(a) an ultraviolet or far ultraviolet monochromatic light source for exposure;

(b) luminous flux dividing means for dividing the exposure luminous flux emitted from said exposure light source into main and auxiliary luminous fluxes;

(c) main mask holding means for holding a main mask substrate for transmitting a portion of said main luminous flux from the portion corresponding to said opening pattern by irradiating a first principal plane

generally at a right angle with said main luminous flux;

(d) auxiliary mask holding means for holding an auxiliary mask substrate for transmitting a portion of said auxiliary luminous flux from the portion corresponding to said opening pattern, by irradiating said first principal plane generally at a right angle with said auxiliary luminous flux;

(e) luminous flux composing means for composing said main luminous flux and said auxiliary luminous flux having passed to emit at least one composed luminous flux;

(f) a projection optical system including a plurality of lenses for focusing said composed luminous flux on the principal plane of a wafer to be exposed, by a reducing projection;

(g) wafer holding means for holding said wafer so that the image plane by said projection optical system may aligned with the resist film on said principal plane of said exposed wafer; and

(h) first phase control means for controlling the relative phase difference between said main luminous flux and said auxiliary luminous flux in the optical paths of said main luminous flux and said auxiliary luminous flux,

wherein the individual optical paths from said exposing light source to said main mask and said auxiliary mask are generally equalized for the exposure except the time necessary for the phase shift, by adjusting said first phase control means.

13. A size-reducing projection exposure system according to Claim 12, wherein the individual optical paths from the primary plane of said wafer to said main mask and said auxiliary mask are generally equalized for the exposure at the time necessary for the phase shift by adjusting said first phase control means.

14. An exposure method for transferring a pattern on at least one mask onto a wafer by a size-reducing projection exposure optical system, comprising:

(a) dividing an exposure luminous flux coming from an exposing ultraviolet or far ultraviolet monochromatic light into a main luminous flux and an auxiliary luminous flux;

(b) irradiating the first principal plane of a main mask, which has a main opening pattern of the minimum size corresponding to the vicinity of the resolution limit of said size-reducing projection exposure opti-

cal system, with said main luminous flux generally at a right angle to emit the transmitted main luminous flux from the second principal plane of said main mask;

(c) irradiating the first principal plane of an auxiliary mask, which has an accompanying opening pattern of the minimum size far smaller than the resolution limit of said size-reducing projection exposure optical system, with said auxiliary luminous flux generally at a right angle to emit the transmitted auxiliary luminous flux from the second principal plane of said auxiliary mask;

(d) composing the emanating main luminous flux and auxiliary luminous flux with a desired phase difference to emit a composed luminous flux; and

(e) projecting said emanated composed luminous flux on the photo resist film on the principal plane of said exposed wafer by the size-reducing projection lens system of said size-reducing projection exposure optical system so that said main luminous flux and said auxiliary luminous flux may have their corresponding portions interfere with each other to focus a clear image.

15. An exposure method according to Claim 14, wherein

said desired phase difference is substantially at (2n + 1)π (in which n: an integer).

16. An exposure method for transferring a pattern on at least one mask onto a wafer by a size-reducing projection exposure optical system, comprising:

(a) dividing an exposure luminous flux coming from an exposing ultraviolet or far ultraviolet monochromatic light into a main luminous flux and an auxiliary luminous flux;

(b) irradiating the first principal plane of a main mask, which has a main opening pattern, which belongs to patterns periodic on at least one axial direction and to be transferred onto said wafer, of the minimum size corresponding to the vicinity of the resolution limit of said size-reducing projection exposure optical system corresponding to an odd array, with said main luminous flux generally at a right angle to emit the transmitted main luminous flux from the second principal plane of said main mask;

(c) irradiating the first principal plane of an auxiliary mask, which has an auxiliary opening pattern, which belongs to said periodic pattern and corresponds to an even array, of the minimum size in the vicinity of the resolution limit of said size-reducing projec-

tion exposure optical system, with said auxiliary luminous flux generally at a right angle to emit the transmitted auxiliary luminous flux from the second principal plane of said auxiliary mask;

(d) composing the emanating main luminous flux and auxiliary luminous flux with a desired phase difference to emit a composed luminous flux; and

(e) projecting said emanated composed luminous flux on the photo resist film on the principal plane of said exposed wafer by the size-reducing projection lens system of said size-reducing projection exposure optical system so that said main luminous flux and said auxiliary luminous flux may interfere with each other to focus a clear image corresponding to said periodic pattern.

17. An exposure method according to Claim 16, wherein said desired phase difference is substantially at $(2n + 1)\pi$ (in which n: an integer).

18. An exposure method according to Claim 17, wherein said desired phase difference is shifted back and forth from the value of $(2n + 1)\pi$ (in which n: an integer) so that the pattern on the wafer corresponding to the opening patterns in the odd array and the

even array may form different best planes.

19. A process for fabricating a semiconductor integrated circuit device for size-reducing projection and exposure of a desired pattern by using an ultraviolet or far ultraviolet monochromatic light, comprising the steps of:

(a) forming a resist pattern for opening contact holes by composing the patterns on the first and second masks optically into a single pattern, in the state in which a positive type resist film is formed on a wafer to be exposed, and by projecting and exposing said wafer in a reduced size with said composed pattern.

20. A process for fabricating a semiconductor integrated circuit device according to Claim 19, further comprising the step of:

(a) forming a resist pattern for forming a band-shaped pattern on said wafer by composing the patterns on the third and fourth masks optically into a single pattern, in the state in which a negative type resist film is formed on a wafer to be exposed, and by projecting and exposing said wafer in a reduced size with said composed pattern.

21. An exposure method for transferring a pattern on at least one mask onto a wafer by a size-reducing projection exposure optical system, comprising:

(a) emitting a first transmitting light from the opening pattern from a first mask by irradiating said first mask with a monochromatic light;

(b) emitting a second transmitting light from the opening pattern from a second mask by irradiating said second mask with a monochromatic light having a wavelength equal to that of the first-named monochromatic light; and

(c) composing said first and second transmitted lights optically to focus the composed light on the photo resist film on said wafer by the projection lens system having the two-side telecentric structure of said size-reducing projection exposure optical system.

22. An exposure method according to Claim 21, wherein the lights for illuminating said first and second masks are emitted from different light sources.

23. An exposure method according to Claim 21, wherein the two lights for illuminating said first and second masks have no mutual interference.

24. An exposure method according to Claim 23, wherein the patterns on said first mask and said second mask are focused on different image planes on said wafer.

25. An exposure method according to Claim 21, wherein the two lights for illuminating said first and second masks have mutual interference.

26. An exposure method according to Claim 25, wherein said first and second illuminating two lights are emitted from a single light source.

27. An exposure method according to Claim 26, wherein said first mask is formed thereon with:
(a) a main opening pattern having the minimum size in the vicinity of the resolution limit of said exposure optical system; and
(b) a shifter opening pattern having a shift layer of a size far smaller than the resolution limit of said exposure optical system and corresponding to said main opening pattern.

28. An exposure method according to Claim 26, wherein said first mask is formed thereon with a first main opening pattern of the minimum size in the vicinity of

the resolution limit of said exposure optical system, wherein said second mask is formed thereon with a second main opening pattern of the minimum size in the vicinity of the resolution limit of said exposure optical system, wherein said first mask is formed thereon with a first accompanying pattern corresponding to said second main opening pattern, wherein said second mask is formed thereon with a second accompanying pattern corresponding to said first main opening pattern, and wherein said first and second accompanying patterns have a size far smaller than the resolution limit of said exposure optical system.

29. An exposure method according to Claim 21, wherein said first and second masks are formed on a single quartz substrate.

30. An exposure method according to Claim 24, wherein the patterns focused on said wafer and corresponding to the opening patterns on said first and second masks are so arranged in the series focal plan that they can be separated at the inside and outside of single- or multiple-connected two-dimensional drawing.

31. An exposure method according to Claim 30, wherein

the pattern inside of said drawing corresponds to a memory-cell-array portion.

32. An exposure method according to Claim 31, wherein the pattern inside of said drawing corresponds to a number of contact or through holes on said memory-cell-array portion, and wherein the pattern outside of said drawing corresponds to a plurality of contact or through holes on a peripheral circuit.

33. A method of inspecting a mask having a first group of opening patterns and a second group of opening patterns for establishing a phase difference of $(2n + 1)\pi$ (in which n: an integer) with said first group, wherein a defective portion is detected: by irradiating both a mask to be inspected and a reference mask, which has a plane opening pattern identical to that of said inspected mask but which will not establish the phase difference between said first group opening patterns and said second group opening patterns, with luminous fluxes having a mutual interference; and by composing the transmitted luminous fluxes optically.

34. A mask inspecting method according to Claim 33,

wherein the patterns of said individual masks are projected in an equal or enlarged scale before or after said composing operation.

35. A mask inspecting method for simultaneously inspecting a first mask having a first group of opening patterns and a second mask having a second group of opening patterns sized not to be resolved at a predetermined exposure step, comprising:
(a) irradiating said first mask with a first luminous flux to emit a first emanating luminous flux;
(b) irradiating said second mask with a second luminous flux to emit a second emanating luminous flux; and
(c) projecting said first and second emanating luminous fluxes at such a magnifying or reducing ratio as to resolve said second group patterns, and composing and focusing said luminous fluxes.

36. A mask inspecting method according to Claim 35, wherein said first and second luminous fluxes have no mutual interference.

37. A mask inspecting method wherein the opening patterns of two masks, which should be so identical that

cannot be resolved at a predetermined exposure step, are composed and projected with a phase difference of $(2n + 1)\pi$ (in which n: an integer) and at such a magnifying or reducing ratio as to revolve themselves.

38. A method of exposing a pattern on a mask, in which a line-and-space-pattern having the minimum size in the vicinity of the resolution limit of a projection exposure system is projected and focused on a wafer by the size-reducing projection and exposure, wherein said mask has the following patterns:

(a) a multiplicity of band-shaped opening patterns formed periodically in one axial direction,

wherein the main opening patterns adjacent to one another are adapted to establish a phase difference of π or equal to it;

(b) a band-shaped accompanying opening pattern formed in the vicinity of the outside of the main openings at the end portion and extending in the longitudinal direction of the main openings, said opening pattern having such a width as cannot be revolved by said exposure optical system,

wherein said accompanying opening pattern extends substantially along the whole length of said main opening patterns at said end portion to establish a

phase difference of π or equal to it with the main openings at said end portion.